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Grupa 233

# Proiect retea neurala(Black-box Classification)

Descrierea modelului utilizat

Arhitectura retelei pe care am folosit-o este urmatoarea:

1. 784 de inputuri ,reprezentand numarul de caracteristici ale exemplelor din multimea de antrenare.
2. Doua straturi ascunse, primul strat cu 100 de perceptroni, iar cel de-a doilea cu jumatate din numarul de perceptroni al primului.
3. Un strat de output cu 10 perceptroni ce returneaza vectori de cate 10 linii si o coloana, indicele liniei cu valoarea maxima fiind eticheta simulata de catre reteaua noastra pentru exemplul respectiv din multimea de antrenare.

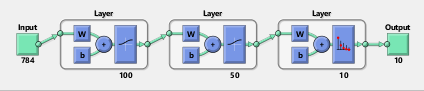
Ca functii de transfer am folosit logsig pentru cele doua straturi ascunse si softmax pentru stratul de output.

logsig(n) = 1 / (1 + exp(-n));

softmax(n) = exp(n)/sum(exp(n));

Pentru functia de antrenare am folosit tranigda ,functie ce implementeaza algoritmul Variable Learning Rate. Daca eroarea la un moment este mai mare decat eroarea de la momentul anterior, actualizarea nu are loc iar rata de invatare scade(se inmulteste cu lr\_dec, care in cazul meu are valoarea 0.6). Altfel, ponderile se actualizeaza iar rata de învăţare creşte (se înmulţeşte cu lr\_inc = 1.05).

Numarul de epoci utilizat la fiecare fold este de 300,rata de invatare este initial 0.05,functia de performanta este msereg, iar ponderile sunt intializate cu valori random distribuite normal intre -1 si 1, dar totusi care sa fie cat mai aproape de 0,de preferat in intervalul [-0.05,0.05].



Codul Matlab insotit de explicatii

function [ output\_args ] = proiect( input\_args )

M=load('trainData.mat');

X=M.trainSamples;

T=M.trainLabels;

test=load('testData.mat');

Tm=zeros(1000,10); %pentru fiecare eticheta creem un vector de 10 elemente cu 1 pe pozitia T(i) si 0 pe celelalte pozitii

for i=1:1000

Tm(i,T(i))=1;

end

Tm1=Tm(1:900,:);

Ant1=X(:,1:900); %impartim multimea de antrenare in doua (900 pe care antrenam si 100 pe care testam

Ant2=X(:,901:1000);

T2=T(901:1000,:); %ultimele 100 de etichete(cele pe care testam)

net=newff(minmax(Ant1),[100 50 10],{'logsig','logsig','softmax'},'traingda');

net.trainParam.goal=1e-5;

net.trainParam.lr = 0.05; %rata de invatare a retelei

net.trainParam.epochs =300; %numarul de epoci

net.IW{1}=randn(100,784)\*sqrt(2/784); %initializam ponderile random in intervalul (-1,1) cat mai aproape de 0

net.trainParam.lr\_inc = 1.05;

net.trainParam.lr\_dec = 0.60;

net.performFcn='msereg'; %functia de performanta

medie=0;

for j=1:10

MC=zeros(10,10); %matricea de confuzie pentru fiecare fold

mis=0;

net=train(net,Ant1,Tm1'); %antrenam si simulam reteaua

y=sim(net,Ant2); %punem in vectorul poz pozitiile maxime de pe fiecare coloana a lui y,ele fiind etichetele prezise

[maxim poz]=max(y);

eroaremedie=mean((poz-T2').^2);

vem(i)=eroaremedie; %vector cu erorile medii

for i=1:100

if poz(i)~= T(i+900) %verificam cate elemente au fost misclasate dupa fiecare fold

mis=mis+1;

end

MC(T(i+900),poz(i))=MC(T(i+900),poz(i))+1; %construim matricea de confuzie

end

medie=medie+mis; %adaugam la medie numarul de elemente misclasate

mis %afisam numarul de elemente misclasate si matricea de confuzie

MC

end

medie/10 %afisam rata medie de precizie

disp('Medie misclasare')

mediemisclasare=mean(vem)

disp('Deviatia standard')

deviatiastandard=std(vem)

eroarestandard=deviatiastandard/sqrt(length(vem));

tscor=tinv([0.05 0.95],length(vem)-1);

disp('Interval incredere')

intervalincredere=mediemisclasare+tscor\*eroarestandard

y=sim(net,test.testSamples); %simulam pe toate cele 5000 de date

[maxim poz]=max(y); %punem in vectorul poz pozitiile elementelor maxime de pe fiecare coloana

csvwrite('rez.csv',poz'); %scriem in fisierul final etichetele prezise

end

Numarul de exemple misclasate si matricea de confuzie pentru fiecare fold

1.

Nr exemple misclasate = 6

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 9 0 0 0 0 0 2 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 1 7 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 5 0

0 0 0 0 0 0 0 1 0 9

2.

Nr exemple misclasate = 4

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 5 0

0 0 0 0 0 0 0 1 0 9

3.

Nr exemple misclasate = 4

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 5 0

0 0 0 0 0 0 0 1 0 9

4.

Nr exemple misclasate = 4

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 5 0

0 0 0 0 0 0 0 1 0 9

5.

Nr exemple misclasate = 4

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 5 0

0 0 0 0 0 0 0 1 0 9

6.

Nr exemple misclasate = 5

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 4 1

0 0 0 0 0 0 0 1 0 9

7.

Nr exemple misclasate = 5

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 4 1

0 0 0 0 0 0 0 1 0 9

8.

Nr exemple misclasate = 4

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 5 0

0 0 0 0 0 0 0 1 0 9

9.

Nr exemple misclasate = 5

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 4 1

0 0 0 0 0 0 0 1 0 9

10.

Nr exemple misclasate = 5

MC=

9 0 0 0 0 0 0 0 0 0

0 11 0 0 0 0 0 0 0 0

0 0 10 0 0 0 0 0 1 0

0 0 0 13 0 0 0 0 0 0

0 1 0 0 7 0 0 0 0 0

0 0 0 0 0 8 0 0 0 0

0 0 0 0 0 0 14 0 0 0

0 0 0 0 0 0 0 10 0 0

0 0 1 0 0 0 0 0 4 1

0 0 0 0 0 0 0 1 0 9

In final, obtinem urmatoarele rezultate:

Rata medie de precizie =

4.4

Medie misclasare =

0.0020

Deviatia standard =

0.0439

Interval incredere 90% =

-0.007 0.0041